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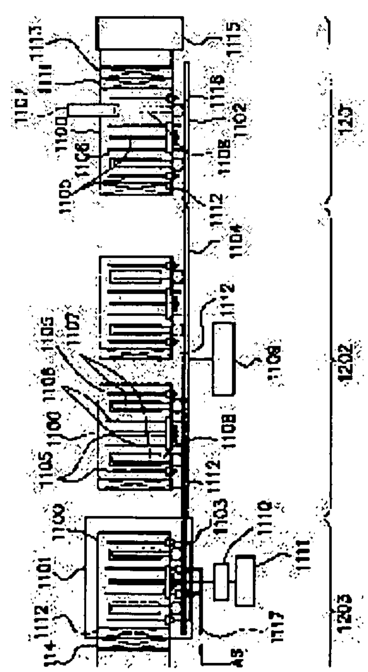
(54) METHOD AND APPARATUS FOR PLASMA TREATMENT



(57)Abstract:

PROBLEM TO BE SOLVED: To enable the mass production of a high quality light receiving member a method in which a reactor is installed freely movably on an orbit, a high frequency power supply system, a treatment gas supply system, and an exhaust system can be connected to the reactor, high frequency plasma is formed in the reactor, and plasma treatment is carried out on a substrate.

SOLUTION: A substrate 1107, after being set to a substrate temperature control means 1108 by a charge stage 1201 in a reactor 1100, is joined to an exhauster 1115. After joining, valves 1111, 1113 are opened, after

the reactor 1100 being exhausted, the valves 1111, 1113 are closed, and the exhauster 1115 is separated. Next, in a transfer stage 1202, the reactor 1100 is moved on a transfer rail 1104. When the reactor 1100 entered a film making chamber 1101, a valve 1114 is opened, and after the chamber 1101 being exhausted, bonding to an exhauster 1116, a high frequency wave supply system (a power source 1111 and others), and a raw material gas supply system 1117 is done. A raw material gas and high frequency power are supplied with exhausting, and films accumulated on the substrate 1107 are formed.

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CLAIMS

[Claim(s)]
[Claim 1] After installing a base in the reaction container which can be decompressed on an injection stage and exhausting the inside of a reaction container, It is the plasma treatment method of performing plasma treatment on the aforementioned base after making a separation processing stage joining the aforementioned reaction container from an injection stage. the aforementioned reaction container The plasma treatment method characterized by moving in an orbit top, joining to a processing stage, joining a RF electric power supply system, a raw-gas supply system, and an exhaust air system to the aforementioned reaction container, forming plasma in the aforementioned reaction container, and performing plasma treatment on the aforementioned base.
[Claim 2] The aforementioned reaction container is the plasma treatment method according to claim 1 of having the electrode and raw-gas introduction means for supplying RF power.
[Claim 3] The aforementioned reaction container is the plasma treatment method according to claim 2 of having a base heating means further.
[Claim 4] It is the plasma treatment method according to claim 1 by which an orbit top is moved to the aforementioned reaction container from the aforementioned injection stage to the aforementioned processing stage.
[Claim 5] It is the plasma treatment method according to claim 4 by which an orbit top is moved to the aforementioned reaction container on the aforementioned injection stage and the aforementioned processing stage.
[Claim 6] The plasma treatment method according to claim 3 of the aforementioned orbit having an electric power supply means, supplying power to the aforementioned base heating means from this orbit, and performing the temperature control of a base.
[Claim 7] The aforementioned orbit is the plasma treatment method according to claim 1 that have an electric power supply means and the electric power supply from this orbit performs the temperature control of the aforementioned reaction container wall.
[Claim 8] The aforementioned orbit is the plasma treatment method according to claim 2 of performing the temperature control of the electrode which has an electric power supply means and supplies RF power by the electric power supply from this orbit.
[Claim 9] The plasma treatment method according to claim 1 which install a base one by one on the aforementioned injection stage, and two or more reaction containers are made to stand by in front of the aforementioned processing stage, joins to a sequential-processing stage as soon as the plasma treatment in a processing stage is completed, and repeats a plasma treatment process.
[Claim 10] The reaction container in front of the aforementioned processing stage is the plasma treatment method according to claim 9 which stands by on an orbit.
[Claim 11] The aforementioned plasma treatment is the plasma treatment method including formation of a deposition film according to claim 1.
[Claim 12] Plasma treatment equipment which has an orbit for the reaction container which can be decompressed, and this reaction container having the exhaust from which it can join together and

secede, and moving the aforementioned reaction container on a plasma treatment stage at least.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the plasma treatment method and plasma treatment equipment. Especially this invention relates to the plasma treatment method and plasma treatment equipment which are used for a semiconductor device, the photo conductor for electrophotography (or photoreception member for electrophotography), the line sensor for a picture input, an image pickup device, a photoelectromotive-force device, etc. and which are represented by formation and etching processing of a deposition film of a semiconductor film, an insulating body membrane, etc. in detail.
[0002]
[Description of the Prior Art] Image form the photoreception for electrophotography incorporated in the electrophotography equipment especially used as a business machine in office -- it is a point with important in the case of a member it being pollution-free at the time of the use From such a viewpoint, the photoreception member for electrophotography which consisted of amorphous silicons (a-Si) compensated with hydrogen or/, and halogens (for example, a fluorine, chlorine, etc.), for example is proposed, and some in it are given to practical use. the amorphous silicon (a-Si) concerned may satisfy the above-mentioned demand mostly -- in addition, the photoreception for electrophotography since it is high endurance -- as a material of a member, it excels very much However, as compared with the photoreception member for electrophotography which consisted of organic semiconductors (OPC) which have spread widely now, since cost is comparatively high, development of the high membrane formation method of the productivity which is stabilized and can produce the quality photoreception member for amorphous silicon electrophotography in large quantities, and equipment is demanded. Although various methods are proposed as the formation method of the deposition film of an amorphous silicon (a-Si), it has spread from the deposition film of a large area being obtained comparatively easily [the plasma CVD method which decomposes material gas by electric fields, such as a direct current, RF and VHF, and microwave, and forms a deposition film on a base in it]. Furthermore, some deposition film formation equipments aiming at improvement in productivity are proposed in recent years using the plasma CVD method. For example, the deposition film formation equipment by the microwave plasma CVD method is indicated by JP,2-197574,A. Equipment given in the official report concerned has a circular dielectric window for microwave introduction, can hold simultaneously two or more bases arranged on the concentric circle centering on the dielectric window, and has the attachment component which can maintain a vacuum at least at the time of deposition film formation, and a means to convey this attachment component in vacuum atmosphere in a row. Furthermore, in the official report concerned, the vacuum housing in which this deposition film formation equipment includes a base, the vacuum housing which performs deposition film formation, the vacuum housing for taking out the base after deposition film formation, and the vacuum housing for movement for moving an attachment component to each vacuum housing are provided, and it is indicated that an attachment component moves each vacuum housing one by one, and deposition film formation is performed. According to this deposition film formation equipment, since a reaction container can be maintained at a vacuum, the

improvement in a certain amount of productivity and mass-production nature and upgrading of the deposition film by prevention of contamination by dust are attained.

[0003]

[Problem(s) to be Solved by the Invention] However, in such equipment, since a limitation is in the speed of movement, the problem of positioning at the time of moving an attachment component into a reaction container etc. has a limitation in a membrane formation cycle to some extent. Moreover, when heating an attachment component before deposition film formation, after moving into a reaction container and heating, when performing deposition film formation, the occupancy time of a reaction container becomes long and there is a problem of being inefficient-like. Although it is also effective to move an attachment component to a reaction container after preparing a heating container and heating an attachment component beforehand in order to improve such a point, since a limitation is in a transit time, by the time it moves to a reaction container, the temperature change of an attachment component may affect a property from the above-mentioned reason. Furthermore, in recent years, various variations have been called for with the high definition more than the former, and quality improvement about the photo conductor for electrophotography which the diversification progresses with highly efficient-ization of the main part of electrophotography equipment, and is used. Moreover, in recently, office-ization [** space] is becoming a user's big needs. In such movement, an indispensable situation has minor diameter-ization with the miniaturization of the main part of electrophotography equipment about the photo conductor for electrophotography to be used, and the performance more than former is demanded with the cost cut.

[0004]

[Objects of the Invention] this invention solves the trouble mentioned above and aims at offering the plasma treatment method excellent in productivity represented by the formation method of a deposition film. Other purposes of this invention are to offer the plasma treatment method which is stabilized cheaply and can form a deposition film, the functional deposition film (semiconductor film) especially used for a semiconductor device, the photoreception member for electrophotography (photo conductor for electrophotography), the line sensor for a picture input, an image pickup device, a photoelectromotive-force device, etc., and the good functional deposition film which has the especially excellent picture nature and which is represented by the formation method of a functional deposition film. Other purposes of this invention are to offer the plasma treatment equipment which can enforce the aforementioned plasma treatment method.

[0005]

[Means for Solving the Problem] this invention solves many problems in the conventional technology mentioned above, and attains the above-mentioned purpose. The plasma treatment method offered by this invention After installing a base in the reaction container which can be decompressed on an injection stage and exhausting the inside of a reaction container, It is the method of performing plasma treatment on the aforementioned base after combining the aforementioned reaction container with a separation processing stage from an injection stage. the aforementioned reaction container It is characterized by moving in an orbit top, joining to a processing stage, joining a RF electric power supply system, a raw-gas supply system, and an exhaust air system to the aforementioned reaction container, forming RF plasma in the aforementioned reaction container, and performing plasma treatment on the aforementioned base. this invention offers the plasma treatment equipment which can enforce this plasma treatment method again. It is characterized by the plasma treatment equipment offered by this invention having an orbit for the reaction container which can be decompressed, and this reaction container having the exhaust from which it can join together and secede, and moving the aforementioned reaction container on a plasma treatment stage at least. In addition, in this invention, the orbit which the aforementioned reaction container moves, for example, a rail, has an electric power supply means, it supplies power to the heating control means of the aforementioned base from this rail, and the temperature control of a base can be performed. the photoreception which consists of efficient and good plasma treatment (a-Si), for example, an amorphous silicon, by this -- the mass production of a member is possible Moreover, in this invention, the mass production of the photoreception member

(photo conductor) which consists of an amorphous silicon (a-Si) which has the more excellent plasma treatment, for example, an electrophotography property, and picture nature is possible by performing the temperature control of a reaction container wall by the electric power supply from the aforementioned rail. The mass production of the photoreception member (photo conductor) which consists of an amorphous silicon (a-Si) which has the further excellent plasma treatment, for example, an electrophotography property, and picture nature is still more possible by performing the temperature control of an electrode which impresses RF power by the electric power supply from the aforementioned rail in this invention.

[0006] Moreover, in this invention, as soon as install a base one by one on the aforementioned injection stage, it makes two or more reaction containers stand by on the aforementioned rail and the plasma treatment (deposition film formation) in a plasma treatment stage is completed, while raising the manufacture baton of a deposition film product by joining an waiting reaction container to a plasma treatment stage one by one, and repeating a plasma treatment process, it is possible to suppress the initial investment of equipment. Furthermore in this invention, it can respond also to manufacture of the amorphous silicon drum of various variations. For example, conventionally, when producing the amorphous silicon drum on which diameters differ in equipment, the housekeeping substitute of equipment etc. took time and it was inefficient-like. However, the reaction container which was set by each diameter according to this invention is prepared, and if the bond part in a plasma treatment stage is carried out in common, it will become producible [the amorphous silicon drum of a diameter which is different in continuation]. By this, it is not concerned with the size of a diameter, but the amorphous silicon drum of various variations can be produced continuously, and control of a production number also becomes easy further. Moreover, dead times, such as a housekeeping substitute, also decrease and it is effective also in respect of a production cost.

[0007] Drawing 1 is the ** type view showing an example of the deposition film formation equipment of a suitable production model to carry out this invention. Hereafter, an example of a procedure which carries out this invention using drawing 1 is explained. In the equipment shown in drawing 1 , the RF impression electrode 1105, the material gas introduction means 1106, and the base temperature-control means 1108 are arranged beforehand at the reaction container 1100 on an orbit 1102 (rail). After setting a base 1107 (here cylinder-like base) first in the reaction container 1100 on the injection stage 1201 at the base temperature-control means 1108, it joins to the exhaust 1115. After being joined, bulbs 1111 and 1113 are opened, after exhausting the inside of the reaction container 1100 enough, bulbs 1111 and 1113 are shut and the reaction container 1100 is separated from the exhaust 1115. On the move stage 1202, the reaction container 1100 by which evacuation was carried out moves in the move rail 1104 top. The move rail 1104 is energized by the power supply 1109, power is supplied to the base temperature-control means 1108 from the move rail 1104, and the temperature control of the cylinder-like base 1107 is made. The reaction container 1100 moves the cylinder-like base 1107 into the membrane formation chamber 1101 of the membrane formation stage 1203, being controlled by desired temperature. When the reaction container 1100 goes into the membrane formation chamber 1101, a bulb 1114 is opened first, the inside of the membrane formation chamber 1101 is exhausted enough, and next, the reaction container 1100 is combined with the exhaust 1116, a RF supply system (a power supply 1111 and matching box 1110), and the material gas supply system 1117. Opening and exhausting a bulb 1112, after combination is made by each, material gas and RF power are supplied in the reaction container 1100, and a deposition film is formed on the cylinder-like base 1107. After deposition film formation is completed, the reaction container 1100 is separated from each bond part, and moves to an ejection process (un-illustrating). waiting [on the move rail 1104] to the membrane formation stage 1203 -- a degree -- the reaction container 1100 is connected and the above-mentioned membrane formation process is started In this way, the mass production of a good photoreception member (photo conductor drum) of the reaction container 1100 is attained by repeating continuously movement (cylinder-like base temperature-control process) and a membrane formation process for an injection process and rail top.

[0008] Drawing 2 is typical explanatory drawing showing another example of this invention. A different point from the equipment of drawing 1 is a point of having not formed the move rail 1104 in the move

stage 1202. By enabling movement of the move stage 1202 freely, as shown in drawing 2 , it becomes possible to give flexibility further by the equipment configuration.
[0009] Drawing 3 and drawing 4 are the ** type views showing an example of the deposition film formation equipment of the production model when not using the method of this invention, respectively. The equipment of drawing 3 is the ** type view showing an example of the mass-production equipment of the type to which the reaction container 2100 is manually moved for the membrane formation stage 2103 from the injection stage 2101. In the equipment shown in drawing 3 , after setting the cylinder-like base 2107 first in the reaction container 2100 on the injection stage 2102 at the base temperature-control means 2108, it joins to the exhaust 2115. After being joined, bulbs 2111 and 2113 are opened, after exhausting the inside of the reaction container 2100 enough and heating the cylinder-like base 2107 to desired temperature, bulbs 2111 and 2113 are shut and the reaction container 2100 is separated from the exhaust 2115. The separated reaction container 2110 is manually moved into the membrane formation chamber 2101 of the membrane formation stage 2103 (move stage 2102). A reactor 2100 is moved to the position of the membrane formation chamber 2101, and a bulb 2112 is combined with 2114, after opening a bulb 2114 first and exhausting the inside of the membrane formation chamber 2101 enough subsequently. Next, the reaction container 2100 is combined with a RF supply system (a power supply 2111 and matching box 2110) and the material gas supply system 2117. Opening and exhausting a bulb 2112, after combination is made by each, material gas and RF power are supplied in the reaction container 2100, and deposition film formation is performed on the cylinder-like base 2107. After deposition film formation is completed, the reaction container 2100 is again separated from each bond part, and is moved to an ejection process (un-illustrating). In this way, the mass production of a photoreception member (photo conductor drum) of the reaction container 2100 is attained by repeating continuously an injection process, a heating process, a move process, and a membrane formation process.
[00010] Drawing 4 is the ** type view of another mass-production equipment improved in order to shorten the occupancy time of the membrane formation chamber 3100. In the membrane formation equipment shown in drawing 4 , the cylinder-like base 3107 is first set to the heating chamber 3200, and the inside of the heating chamber 3200 is exhausted. After the cylinder-like base 3107 is heated by desired temperature by the base heating control means 3108 within this heating chamber, it is conveyed by the membrane formation chamber 3100 by the conveyance chamber 3300, and deposition film formation is performed like the above-mentioned. after a deposition film formation end, it takes out by the conveyance chamber 3400 and conveys to a chamber 3500 -- having -- a photoreception -- a member 3600 (photo conductor drum) is taken out While a base is moved to a membrane formation chamber in the case of a mass-production system as shown in drawing 3 and drawing 4 , temperature's falling, dispersion of the initial temperature at the time of a membrane formation start, etc. may occur. In the case of the equipment shown especially in drawing 3 , positioning by the membrane formation chamber and the joint work of each bond part tend to come out of a difference to a duration by the operator, and there is a problem that management is difficult. Although shortening of conveyance time and the technique of establishing the source of heating also in a conveyance chamber can be considered in order to suppress such a temperature change resulting from dispersion in time until it combines a reaction container, an equipment configuration becomes complicated in this case, and it is not practical.
[00011] According to this invention, while the reaction container 1100 moves in a rail top, since the cylinder-like base 1107 can carry out a temperature control, dispersion in the initial temperature of the base at the time of a deposition film start can control it enough. It is stabilized by this and the mass production of a good photoreception member (photo conductor drum) is possible. Moreover, in this invention, since a vacuum conveyance mechanism becomes unnecessary, an initial investment can also be suppressed. Furthermore, the parts in reaction containers other than a cylinder-like base (a ****** wall, RF impression electrode 1105) etc. can be easily heated by the electric power supply from a rail before deposition film formation. By carrying out such operation, the adhesion of the deposition film of the portion in reaction containers other than a cylinder-like base improves, occurrence of the defect in the deposition film resulting from film peeling inside a reaction container is suppressed, and the mass

production of a photoreception member (photo conductor drum) which has a good property is attained. In this invention, the reaction container 1100 can arrange the electrode, the material gas introduction means, and base heating control means which impress RF power, and if it is a gestalt in which vacuum maintenance is possible, especially a limit especially will not have it in a configuration, the quality of the material, composition, etc. In order to form a good deposition film by homogeneity over a cylinder-like base perimeter especially, composition as shown in drawing 5 (A) and drawing 5 (B) is considered as a desirable example. Drawing 5 (A) and drawing 5 (B) are the level cross sections having shown an example of arrangement of the cylinder-like base inside the reaction container of this invention and a RF power impression electrode, and a material gas introduction means, respectively. In drawing 5 (A) and 5 (B), in a reaction container and 4105, a RF power impression electrode and 4106 show a material gas introduction means, and 4107 shows [4100] a cylinder-like base, respectively. Moreover, the reaction container 1100 needs to have composition with the movable and move rail 1104 top in which the electric power supply from a move rail is possible. For example, as shown in drawing 1 , the conductor wheel 1118 is formed in the reaction container 1100, and an electric power supply can be carried out to the base heating means 1108 through this wheel. In this invention, the membrane formation stage 1203 consists of RF electric power supply systems which consist of the membrane formation chamber 1101, the material gas supply system 1117, RF generator 1111, and a matching box 1111. Each supply system is the position where the reaction container 1100 was connected with the exhaust air system 1116, and connecting with a reaction container, respectively is desirable. Furthermore, it is desirable on safe that exhaust air processing is carried out until deposition film formation is completed from from and supply of a RF generator and material gas stops the membrane formation chamber 1101, when each supply system and an exhaust air system are connected at least.

[0012] Drawing 6 is a ** type view for explaining an example of the lamination of the photoreception member (photo conductor for electrophotography) produced by this invention. the photoreception shown in drawing 6 -- in the member 500, the photoreception layer 502 is formed on the base 501 This photoreception layer 502 consists of a photoconduction layer 503 which consists of a-Si:H and X and has a photoconductivity, an amorphous silicon system surface layer 504, and an amorphous silicon system charge pouring blocking layer 505. In this invention, as material gas used for production of the photo conductor for electrophotography, when forming an amorphous silicon film, for example, the silicon hydride (silanes) which is in gas states, such as SiH4, Si2H6, Si3H8, and Si4H10, or can be gasified easily can use it effectively as material gas for Si supply. The silicon compound containing the fluorine atom other than these silicon hydrides, the silane derivative replaced by the so-called fluorine atom, and the compound which have the shape of gas, such as silicon fluorides, such as SiF4 and Si2F6, and fluorine substitution silicon hydrides, such as SiH3F, SiH2F2, and SiHF3, or can specifically be gasified easily can also be used as material gas for Si supply. Moreover, you may use these material gas for Si supply if needed, diluting it by gas, such as H2, helium, Ar, and Ne. the material gas for membrane formation mentioned above -- in addition, the need -- responding -- the [periodic-table] -- the compound which has an atom belonging to an III group or the Vth group as a composition atom can be used as an object for doping For example, when using a boron atom (B) as a dopant, compounds, such as halogenation boron, such as potassium borohydrides, such as B-2 H6 and B4H10, and BF3, BCl3, can be used. Moreover, when using the Lynn atom as a dopant, compounds, such as halogenation phosphorus, such as hydrogenation phosphorus, such as PH3 and P2H4, PH4I, platelet factor 3, and PCl3, PBr3, PI3, can also be used.

[0013] As for the thickness of the photoconduction layer 503, it is preferably [according to a request, it is suitably determined from points, such as that a desired electrophotography property is acquired and an economical effect, and] desirable more preferably to be referred to as 25-40 micrometers the optimal 20-45 micrometers 15-50 micrometers. In order to form the photoconduction layer which has a desired property, it is required to set base temperature as the mixing ratio of the material gas for Si supply and dilution gas, the gas pressure in a reaction container, and an electric discharge power row suitably. Although the optimal range is suitably chosen according to a layer design, as for the flow rate of H2 used as dilution gas, it is desirable to carry out control changed in the 3 to 10 times as many range as this

the optimal two to 15 times for H2 preferably one to 20 times to the material gas for Si supply in the usual case. Although the optimal range is suitably chosen similarly [electric discharge power] depending on a layer design and the gestalt of membrane formation equipment, in order to acquire sufficient rate of sedimentation and a film property, in the usual case, it is desirable to set preferably the electric discharge power to the flow rate of the material gas for Si supply as the 3 to 5 times as many range as this the optimal 2.5 to 10 times two to 20 times. Furthermore, it is preferably desirable [the temperature of the base 501 at the time of membrane formation] in the usual case, although the optimal range is suitably chosen according to a layer design more preferably to consider as 250-310 degrees C the optimal 230-330 degrees C 200-350 degrees C. Although the range described above as the base temperature for forming the photoconduction layer 503 and a desirable numerical range of gas pressure is mentioned, as for these conditions, it is [that the photoreception member which is not usually separately decided in independent and has a desired property should be produced] desirable mutual to decide an optimum value based on organic relevance.

[0014] As a cylinder-like base used in this invention, you may be electric insulation also in conductivity. As the concrete quality of the material, metals, such as aluminum, Cr, Mo, Au, In, Nb, Te, V, Ti, Pt, Pd, and Fe, and these alloys, for example, stainless steel etc., are mentioned. Moreover, the base which carried out electric conduction processing of the front face of the side which forms a photoreception layer at least of electric insulation bases, such as a film of synthetic resin, such as polyester, polyethylene, a polycarbonate, a cellulose acetate, polypropylene, a polyvinyl chloride, polystyrene, and a polyamide, or a sheet, glass, and a ceramic, can also be used. In performing image record using coherency light, such as a laser beam, especially, in order to cancel more effectively the poor picture by the so-called interference fringe pattern which appears in a visible image, you may prepare irregularity in the front face of a base 501. The irregularity prepared in the front face of a base 501 can be formed by the well-known method indicated by JP,60-168156,A, the 60-178457 official report, the 60-225854 official report, etc. moreover, the poor picture by the interference fringe pattern at the time of using the coherent lights, such as a laser beam, -- a twist -- you may prepare the shape of toothing by two or more spherical trace hollows in the front face of a base 501 as an option canceled effectively namely, the front face of a base 501 -- a photoreception -- having irregularity very smaller than the resolution required of a member 500, moreover, this irregularity calls at two or more spherical trace hollows The irregularity by two or more spherical trace hollows established in the front face of a base 501 can be formed by the well-known method indicated by JP,61-231561,A.

[0015] The charge pouring blocking layer 505 has the function which prevents that a charge is poured into a photoconduction layer side from a base side, when the photoreception layer 502 receives polar fixed electrification processing in the free surface, and when reverse polar electrification processing is received, such a function has the so-called polar dependency which is not demonstrated. In order to give such a function, the charge pouring blocking layer 505 is made to contain comparatively many atoms which control conductivity compared with the photoconduction layer 503. Although the atom which controls the conductivity contained in the charge pouring blocking layer 505 may be uniformly distributed in this layer or being uniformly contained in the direction of thickness, there may be a portion contained in the state where it is distributed unevenly. When a concentration distribution is uneven, it is suitable to make it contain so that it may be mostly distributed in a base side. However, in any case, in the front face and parallel side inboard of a base, to contain uniformly by uniform distribution is required also from the point of achieving equalization of the property in field inboard. the [which can mention the so-called impurity in a semiconductor field, and gives p type conduction property as an atom which controls the conductivity contained in the charge pouring blocking layer 505 / periodic-table] -- the [which gives the atom (henceforth -- "-- the -- it is written as IIIb group atom") or the n-type-conduction property belonging to an IIIb group / periodic-table] -- the atom (henceforth -- "-- the -- it writes as Vb group atom") belonging to a Vb group can use the -- as an IIIb group atom, specifically, B (boron), aluminum (aluminum), Ga (gallium), In (indium), Tl (thallium), etc. are mentioned, and B, aluminum, and Ga are suitable especially in these the -- as a Vb group atom, P (Lynn), As (arsenic), Sb (antimony), Bi (bismuth), etc. are specifically mentioned, and P and As are

suitable especially in these although it is suitably determined as an amount of the atom which controls the conductivity contained in the charge pouring blocking layer 505 that the desired purpose can attain effectively -- desirable -- the 10 - 1x104 atom ppm -- it is more suitably desirable the 50 - 5x103 atom ppm and to consider as the 100 - 1000 atom ppm the optimal Furthermore, to the charge pouring blocking layer 505, improvement in the adhesion between other layers which contact this charge pouring blocking layer directly, and are prepared in it can be aimed at by [in a carbon atom, a nitrogen atom, and an oxygen atom] making a kind contain at least. Although it may be distributed in the carbon atom contained in this charge pouring blocking layer, a nitrogen atom, and an oxygen atom uniformly uniformly [a kind] in this layer at least or being uniformly contained in the direction of thickness, there may be a portion contained in the state where it is distributed unevenly. However, in any case, in the front face and parallel side inboard of a base, to contain uniformly by uniform distribution is required also from the point of attaining equalization of the property in field inboard. As for the thickness of a charge pouring blocking layer, it is desirable to set more preferably 0.3-4-micrometer 0.1-5 micrometers to 0.5-3 micrometers the optimal from points, such as that a desired electrophotography property is acquired and an economical effect.

[0016] In case the charge pouring blocking layer 505 is formed, it is required to set the temperature of a base 501 as the mixing ratio of the material gas for Si supply and dilution gas, the gas pressure in a reaction container, and an electric discharge power row suitably like the case of the photoconduction layer described previously. Although the optimal range is suitably chosen according to a layer design, as for the flow rate of H2 which is dilution gas, and/or helium, in the usual case, it is desirable to the material gas for Si supply to control H2 and/or helium in the 5 to 10 times as many range as this the optimal three to 15 times preferably one to 20 times. Although the optimal range is suitably chosen similarly [electric discharge power] depending on a layer design and the gestalt of membrane formation equipment, in the usual case, it is desirable to set preferably the electric discharge power to the flow rate of the material gas for Si supply as the 3 to 5 times as many range as this the optimal two to 6 times one to 7 times. Furthermore, it is preferably desirable [the temperature of a base 501] in the usual case, although the optimal range is suitably chosen according to a layer design more preferably to consider as 250-310 degrees C the optimal 230-330 degrees C 200-350 degrees C.

[0017] As long as the component of a surface layer 504 is the material of an amorphous silicon system, it may be which thing. As such a material, a hydrogen atom (H) and/or a halogen atom (X) are contained, for example. The amorphous silicon which furthermore contains a carbon atom (it is written as "a-SiC:H, X" below), The amorphous silicon which contains a hydrogen atom (H) and/or a halogen atom (X), and contains an oxygen atom further (it is written as "a-SiO:H, X" below), The amorphous silicon which contains a hydrogen atom (H) and/or a halogen atom (X), and contains a nitrogen atom further (it is written as "a-SiN:H, X" below), The amorphous silicon (it is written as "a-Si:C, O, N:H, X" below) which contains a hydrogen atom (H) and/or a halogen atom (X), and contains at least two sorts in a carbon atom, an oxygen atom, and a nitrogen atom further is mentioned. Especially, the material which makes a-SiC a principal component is desirable. You may be these other amorphous carbon (a-C). although the numerical conditions of a membrane formation parameter are suitably set up and formed so that, as for a surface layer 504, a request property may be acquired -- a photoreception -- it is desirable to be based on the same forming-membranes method as a photoconduction layer and a charge pouring blocking layer from a viewpoint of the productivity of a member As matter which may serve as material gas for Si supply used in formation of a surface layer 504 The silicon hydride (silanes) which is in gas states, such as SiH4, Si2H6, Si3H8, and Si4H10, or can be gasified is mentioned, and SiH4 and Si2H6 are still more desirable in respect of the goodness of Si supply efficiency etc. in these in the ease of dealing with it at the time of layer production. Moreover, you may use these material gas for Si supply if needed, diluting it by gas, such as H2, helium, Ar, and Ne. The hydrocarbon which is in gas states, such as CH4, C2H6, C3H8, and C4H10, or can be gasified as matter which may serve as material gas for (Carbon C) supply is mentioned as what is used effectively. CH4 and C2H6 are still more desirable in respect of the goodness of C supply efficiency etc. in the ease of dealing with it at the time of the stratification in these. Moreover, you may use these material gas for C supply if needed, diluting it by

gas, such as H2, helium, Ar, and Ne. As thickness of a surface layer 504, it is usually suitably desirable to be referred to as 0.1-1 micrometer the optimal 0.05-2 micrometers 0.01-3 micrometers. If thickness is thinner than 0.01 micrometers, while using a photoreception member, a surface layer will be lost for the reasons of wear etc., and when 3 micrometers is exceeded, the fall of properties, such as an increase in a rest potential, may be seen. the prevented type photoreception which mentioned this invention above -- a high resistance type photoreception member besides a member, and a functional discrete-type photoreception -- the photoreception used for copying machines, such as a member, a printer, etc. -- it is applicable to any [besides a member] production of a device

[0018]

[Example] Hereafter, although this invention is explained in detail based on an example, this invention is not limited at all by these.

[0019]

[Example 1] The time taken to have combined with the membrane formation stage, to have passed material gas, and to form plasma using the equipment of this invention shown in drawing 1 after separating the reaction container from the injection stage was measured. That is, I had the above-mentioned work done on ten operators to A-J, respectively, and the time concerning each was measured.

[0020]

[The example 1 of comparison] The time taken to have combined with the membrane formation stage, to have passed material gas, and to form plasma using the equipment shown in drawing 3 without a rail after separating the reaction container from the injection stage like the example 1 was measured. That is, I had the above-mentioned work done on ten operators to the same A-J as an example 1, respectively, and the time concerning each was measured. In addition, the distance of a membrane formation stage and an injection stage presupposed that it is the same as an example 1.

[0021] The result obtained in the example 1 and the example 1 of comparison is shown in Table 1. Considering the result shown in Table 1, in the example 1 by the method of this invention, it turns out that time until it moves a reaction container compared with the example 1 of comparison and combines with a membrane formation stage is shortened so that clearly. Moreover, the time difference by the worker is also known by being shortened in the example 1 by the method of this invention.

[0022]

[Example 2] Carry out mirror-plane processing of the aluminum cylinder with the outer diameter of 80mm, a length [of 358mm], and a thickness of 5mm, use as a cylinder-like base what carried out degreasing washing, and with the procedure described previously using the equipment of this invention of drawing 1 Continuation 30 cycle formation of the prevention type photoreception member for electrophotography of lamination (it is henceforth called a "drum") which consists of the charge pouring blocking layer and photoconduction layer which are shown in drawing 6 on the conditions shown in Table 2, and a surface layer was carried out. The produced drum was set in electrophotography equipment (Canon NP6750 is converted into a test), and the following methods estimated the following electrophotography properties.

Sensitivity -- The photoreception member for electrophotography is electrified in fixed dark space surface potential. And a light figure is irradiated immediately. A light figure irradiates the light except the light of a wavelength region 600nm or more using a filter using the xenon lamp light source. this time -- a surface potential meter -- a photoreception -- the bright section surface potential of a member is measured Light exposure is adjusted so that bright section surface potential may turn into predetermined potential, and it considers as sensitivity with the light exposure at this time. Sensitivity was evaluated by the above-mentioned technique about each of the produced above-mentioned drum, and dispersion from a reference value was shown in the graph of drawing 7 .

[0023]

[The example 2 of comparison] Like the example 2, mirror-plane processing of the aluminum cylinder with the outer diameter of 80mm, a length [of 358mm], and a thickness of 5mm was carried out, what carried out degreasing washing was used as a base, and continuation 30 cycle formation of the

prevention type drum of lamination which consists of the charge pouring blocking layer and photoconduction layer which are shown in drawing 6 , and a surface layer on the conditions shown in Table 2 was carried out using the conventional equipment of drawing 3 . About each of the produced drum, sensitivity was evaluated like the example 2 and dispersion in sensitivity was shown in the graph of drawing 8 .

[0024] Considering drawing 7 (evaluation result of an example 2), and drawing 8 (evaluation result of the example 2 of comparison), it turns out that dispersion in sensitivity has been improved compared with the method of the former [drum / which was produced by the method of this invention] so that clearly.

[0025]

[Example 3] In this example, the amorphous silicon drum was produced like the example 2 using the mass-production equipment of this invention of drawing 1 . In addition, in this example, while the reaction container performed the temperature control of a cylinder-like base on the rail, the electric power supply was performed also to the reaction container wall and the RF electrode, and the temperature control was performed for each at 200 degrees C. In this way, the produced drum was set in electrophotography equipment (Canon NP6750 is converted into a test), and evaluation of an electrophotography property and picture nature was performed by the following methods.

Electrification ability temperature characteristic -- The drum was electrified in fixed dark space surface potential, the temperature of a drum was changed from a room temperature to about 45 degrees C, electrification ability was measured, and change of the electrification ability per temperature of 1 degree C at this time was measured.

Picture defect -- The number was counted about the flake with a diameter [in the same area of the copy picture acquired when the Canon halftone chart (part number : FY 9-9042) was put on a manuscript base and copied] of 0.5mm or less.

[0026]

[The example 3 of comparison] In the example of comparison, the amorphous silicon drum was produced like the example 2 except not performing an electric power supply to a reaction container wall and a RF electrode, and not performing a temperature control. It evaluated like the example 3 about each of the obtained drum. Consequently, it turns out that the electrification ability temperature characteristic and picture defective level of the drum produced in the example 3 improve about twenty percent compared with the drum produced in the example 3 of comparison.

[0027]

[Example 4] In this example, using the mass-production equipment of this invention of drawing 1 , in the reaction container of composition of having been shown in drawing 5 (A) The outer diameter of 80mm, What carried out mirror-plane processing of the aluminum cylinder with a length [of 358mm], and a thickness of 5mm, and was set as a base using what carried out degreasing washing, On the conditions which used by turns what carried out mirror-plane processing of the aluminum cylinder with the outer diameter of 60mm, a length [of 358mm], and a thickness of 5mm, and was set to the reaction container of composition of having been shown in drawing 5 (B) as a base using what carried out degreasing washing, and were shown in Table 2 The amorphous silicon drum on which outer diameters differ was continuously produced 30 cycles for every cycle with the composition shown in drawing 6 .

[0028]

[The example 4 of comparison] The conventional mass-production equipment shown in drawing 4 was used, and two or more amorphous silicon drums were similarly produced in the example 4. Consequently, the time conventionally taken to produce an example 4 and equivalent numbers including a housekeeping substitute in the example 4 of comparison using equipment was about 1.5 times.

[0029]

[Table 1]

作業員	A	B	C	D	E	F	G	H	I	J	平均	δT
実施例1	29.5	29.6	30.0	29.8	29.9	30.0	29.5	29.5	29.6	29.9	29.7	0.5
比較例1	42.5	45.0	48.0	48.0	46.7	50.8	43.6	44.4	52.5	48.2	47.0	10.0

※δT＝最大所要時間－最小所要時間

[0030]
[Table 2]

	阻止層	光導電層	表面層
原料ガス流量 (sccm)	SiH_4 300 H_2 100 B_2H_6 500ppm (SiH_4に対して)	SiH_4 300 B_2H_6 1.5ppm (SiH_4に対して)	SiH_4 30 H_2 100 CH_4 500
高周波電力 (W)	3000	3000	3000
高周波周波数	105MHz	105MHz	105MHz
内圧 (mTorr)	10	10	10

[0031]
[Effect of the Invention] According to this invention, a manufacture baton can be raised and plasma treatment (for example, a photoreception mass production of a member) can be carried out efficiently. Furthermore, by making a move rail energize and carrying out the temperature control of the base (for example, cylinder-like base) using the power, the temperature change of the base under movement of a reaction container is suppressed, the temperature of dispersion of the base at the time of a plasma treatment (for example, membrane formation) start decreases the whole lot, and dispersion in a property can be reduced. Furthermore, although the reduction of the impurity by the improvement in adhesion of the deposition film in a reaction container and the baking effect of a cause etc. is indefinite by carrying out the temperature control of a reaction-chamber wall, the RF impression electrode, etc., there are few picture defects and formation of the amorphous silicon drum whose electrification ability temperature characteristic improved is attained. According to this invention, plasma treatment can be performed cheaply and efficiently and the amorphous silicon photo conductor with which diameters differ can be manufactured cheaply and efficiently in a concrete example.

[Translation done.]